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Technology backstopping for management of insect pests and diseases of potato in farmer's field

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ABSTRACT

Integrated management practices in potato against major insect pests and diseases were demonstrated by ICAR-Krishi Vigyan Kendra, Kolar, Karnataka (India) through Frontline demonstration (FLD) and Farmer's field school (FFS) in the selected potato farmer's fields during 2015-16 and 2017-18. Effect of the demonstrated technologies on pest management was quite encouraging and resulted in reduction in mean mite incidence (1.46/leaf), defoliator incidence (0.49/plant) and potato tuber moth incidence (0.40/plant) as compared to farmer's practice plots. Similar effect was noted on disease management wherein demonstrated plots recorded least mean late blight incidence (4.96 PDI), early blight incidence (3.65 PDI) and Sclerotium wilt incidence (0.82 %) over the farmer's practice plots. These insect pests and diseases have major impact on crop yield. The average increase in potato tuber yield in demonstration plots was 3.63 t/ha (19.13 %) over farmers practice. Further, upon adoption of integrated management practices, growers have realized higher mean net returns (127982 Rs./ha) and benefit cost ratio (1.82) as against the farmers practice (82252 Rs./ha and 1.53 of net returns and benefit cost ratio, respectively). The difference in the yield was mainly due to adoption of integrated insect pests and disease management practices by the potato farmers as demonstrated by the KVK. Thus, the demonstrated technologies proved to be highly effective in management of insect pests and diseases compared to the existing farmers practice for the potato growers of the district.

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INTRODUCTION

The potato is the world's fourth most important food crop after rice, wheat and maize. India is one of the largest potato producers with an area of 1.9 million hectare, with a total annual production of 45.3 million tonnes and with the productivity of 18.70 t/ha (Anonymous, 2012). In Karnataka, Kolar, Chikkaballapur, Bengaluru rural district, Hassan, Chikkamangaluru,

Belgaum and Dharwad are major potato growing districts where the crop is cultivated in *Kharif* and *Rabi* seasons.

In Kolar potato is cultivated in an area of 6951 ha and average yield per hectare is very low (15.53 t/ha). The low productivity is mainly due to occurrence of various insect pests and diseases. Crop in the region suffers from the insect pests like yellow mite, potato tuber moth (*Phthorimoea operculella*) and defoliators. The sucking insects act as vector of viral diseases (Hanafi, 1999). Likewise, late blight (*Phytophthora infestans*), early blight (*Alternaria solani*) and Sclerotium wilt (*Sclerotium rolfsii*) are most common and serious diseases causing huge yield loss every year.

Among the diseases, late blight is the most dreaded disease caused by the fungus *Phytophthora infestans*. The disease affects foliage as well as tubers, and severity of damage depends upon the disease incidence and the variety planted. Late blight pathogen survives from one season to another through infected seed tubers serving as the primary source of inoculum (Fry and Goodwin, 1997). Further, early blight, Sclerotium wilt, mites, defoliators and tuber moth are regular in occurrence and impact the tuber yield in the region.

The other reasons for low yield are lack of knowledge among growers about improved integrated pest and diseases management (IPDM) practices in potato to manage the debilitating insect pests and diseases. In view of these problems faced by potato growers in the district, KVK intervened with suitable technology backstopping through FLDs and FFS on IPDM practices in potato.

MATERIAL AND METHODS

ICAR-Krishi Vigyan Kendra, Kolar is playing crucial role in technology backstopping for management of insect pests and diseases of potato to the farmers of Kolar district. In this connection, KVK, Kolar had demonstrated the improved integrated insect pests and diseases management practices (IPDM) in potato through frontline demonstration (FLD) and farmer's field school (FFS) during 2015-16 and 2017-18. During 2015-16, FLD was conducted in Seegenahalli in ten potato grower's field. Likewise, during 2017-18, FLD was conducted in Seethahalli in ten potato grower's field and FFS was conducted in Punyahalli in one potato farmer's field. The agronomic practices recommended by UHS Bagalkot were followed to raise the crop. Technologies related to IPDM in potato were demonstrated in the entire crop stages (pre-planting, planting till harvesting) details of which are given Table A.

Observations on insect pests and disease *viz.*, mite incidence (number/leaf), defoliator incidence (number/plant), potato tuber moth incidence (number/plant), late blight incidence (PDI), early blight incidence (PDI) and Sclerotium wilt incidence (%) were recorded visually eight days before harvest and potato tuber yield observations were recorded at harvest in demonstration and farmer's practice plot.

Table A: Demonstration of the entire crop stages in potato using technologies related to IPDM

Particular	Details	Source of technology
Demonstration (FLD/FFS)	Soil application of bio-agents (*Trichoderma harzianum* and *Pseudomonas fluorescens* @1kg each/100 kg FYM spot application 15 days before planting), Tuber treatment with Mancozeb @ 0.25%, prophylactic spray with Mancozeb @ 0.2% twice at weekly interval before onset of the disease, curative sprays with Cymoxanil+Mancozeb @ 0.3%, Dimethomorph @ 1.0% +Mancozeb @ 0.2%, and Fenamidone+Mancozeb @ 0.3% at weekly interval at onset of the disease (for late blight), spray with Difenoconazole @ 0.1% (for early blight), Fenazaquin @ 0.2%/ Dicofol @ 0.25% (for mite), Chlorpyrifos @ 0.25%/ Quinalphos @ 0.2%/ Phosalone @ 0.2% (for defoliators and potato tuber moth)	UAS, Bengaluru; UHS Bagalkot and CPRI, Shimla
Farmer's practice	Indiscriminate spray of one or combination of two fungicide or insecticides *viz.*, Mancozeb @ 0.2%, Dimethomorph @ 0.1% + Metiram @ 0.2%, Copper Oxy Chloride @ 0.3%, Fenamidone + Mancozeb @ 0.3%, Metalaxyl + Mancozeb @ 0.2%, Cymoxanil + Mancozeb @ 0.3%, Copper Hydroxide @ 0.2%, Propineb @ 0.2%, Chlorothalonil @ 0.2% Imidachloprid @ 0.05%, Acephate @ 0.15%/ Thiamethoxam @ 0.05%/ Fipronil @ 0.1%/ NSKE @ 5%/ Triazophos @ 0.2%, Chlorantraniliprole @ 0.05%, Emamectin benzoate @ 0.05%/ Spinosad @ 0.05%, Acetamprid @0.05% at weekly intervals starting from disease or insect pest onset till completion of crop cycle.	-

The early blight disease assessments were made by following 0-7 severity scale (Christ, 1991) and details of which are presented Table B.

Table B: Early blight disease by 0-7 severity scale

Plant area infected (%)	Score
No lesions	0
Trace to 1	1
1-5	2
6-10	3
11-25	4
26-50	5
51-75	6
76-100	7

Similarly, late blight disease assessments were made by following 1-9 severity scale (Malcolmson, 1976) and details of which are presented Table C.

Table C: Late blight disease assessments by 1-9 severity scale

Plant area infected (%)	Score
Trace of infection	9
<10	8
11-25	7
26-40	6
41-60	5
61-70	4
71-80	3
81-90	2
Collapsed	1

The disease index (%) of early and late blight was computed using the following formula (Wheeler, 1969),

$$\text{Disease index (\%)} = \frac{\text{Sum of all individual ratings}}{\text{Total number of plants examined x Maximum score}} \times 100$$

RESULTS AND DISCUSSION

The effect of the demonstrated technologies on insect pests and diseases management in potato was quite encouraging and results are presented hereunder. During 2015-16 the demo plots recorded reduced incidence of insect pests and disease *viz.*, mite (1.60/leaf), defoliator (0.39/plant), potato tuber moth (0.34/plant), late blight (5.70 PDI), early blight (4.12 PDI) and Sclerotium wilt (0.72 %) as against farmer's practice plots which recorded higher incidence of insect pests and diseases (mite-1.46/leaf, defoliator - 0.49/plant, potato tuber moth- 0.40/plant, late blight - 5.70 PDI, early blight - 4.12 PDI and Sclerotium wilt - 0.72 %). Similar trend was noted during 2017-18. Mean pooled data of two years followed the similar trend wherein demo plots noted with low incidence of mite (1.46/ leaf), defoliator (0.49/plant), potato tuber moth (0.40/plant), late blight (4.96 PDI), early blight (3.65 PDI) and Sclerotium wilt (0.82%) compared to farmer's practice plots which recorded higher incidence of above mentioned insect pests and diseases (Table 1 and 2).

The demonstrated technologies had huge impact on yield and economics of technology adopted potato growers. During 2015-16 the demo plots recorded higher tuber yield of 21.15 t/ha which was 19.02 per cent increase over the farmer's practice plot (17.77 t/ha). Same trend was evidenced during 2017-18 and even in mean pooled data of two years the same trend noticed wherein 19.13 per cent increase in yield over the farmer's practice plot was evidenced. Further, upon adoption of integrated management practices, growers have realized higher mean net returns (127982 Rs./ha) and benefit cost ratio (1.82) as against the farmers practice (82252 Rs./ha and 1.53 of net returns and benefit cost ratio, respectively) (Table 3).

In the study, low incidence of late blight was observed in demo plots which might be mainly because the technologies demonstrated to manage the deadly late blight of potato consist of diverse strategies *viz.*, soil application of bio-agents (1 kg each talc formulation of *Trichoderma harzianum* and *Pseudomonas fluorescens* multiplied in 100 kg well decomposed FYM) 15 days before planting, Tuber treatment with Mancozeb (@ 0.25%), Prophylactic spray with Mancozeb @ 0.2% twice at weekly interval before onset of the disease, Curative sprays with Cymoxanil + Mancozeb @ 0.3%, Dimethomorph @ 1.0% + Mancozeb @ 0.2%, and

Table 1: Effect of demonstrated technologies on status of insect pests of potato in farmer's field during 2015-16 and 2017-18

Parameter	2015-16		2017-18		Pooled results of two years	
	Demonstration	Farmer's practice	Demonstration	Farmer's practice	Demonstration	Farmer's practice
Mite incidence (no./leaf)	1.60	4.80	1.31	3.18	1.46	3.99
Defoliator incidence (no./plant)	0.39	1.21	0.58	1.36	0.49	1.29
Potato tuber moth incidence (no./plant)	0.34	0.97	0.46	1.13	0.40	1.05

Table 2 : Effect of demonstrated technologies on status of diseases of potato in farmer's field during 2015-16 and 2017-18

Parameter	2015-16		2017-18		Pooled results of two years	
	Demonstration	Farmer's practice	Demonstration	Farmer's practice	Demonstration	Farmer's practice
Late blight incidence (PDI)	5.70	13.54	4.22	17.28	4.96	15.41
Early blight incidence (PDI)	4.12	12.34	3.17	11.39	3.65	11.87
Sclerotium wilt incidence (%)	0.72	2.35	0.91	3.10	0.82	2.73

Table 3 : Effect of demonstrated technologies on yield and economics of potato farmers during 2015-16 and 2017-18

Parameter	2015-16		2017-18		Pooled results of two years	
	Demonstration	Farmer's practice	Demonstration	Farmer's practice	Demonstration	Farmer's practice
Yield (t/ha)	21.15	17.77	24.04	20.17	22.60	18.97
Gross cost (Rs./ha)	155240	159209	159461	155361	157351	157285
Gross returns (Rs./ha)	267720	224933	302946	254142	285333	239538
Net returns (Rs./ha)	112480	65724	143484	98780	127982	82252
Benefit cost ratio	1.73	1.41	1.90	1.64	1.82	1.53

Fenamidone + Mancozeb @ 0.3% at weekly interval at onset of the disease which are likely to be active during the entire crop cycle under field conditions and turned out to be most efficient in management of disease. These results are in line with report of Haveri *et al.* (2018). Further, soil application of bioagent enriched FYM might be reason for less incidence of Sclerotium wilt in demo plots. The mean early blight incidence in demo plots was low compared to farmer's practice plot which might be due timely application of triazole group of fungicide *i.e.*, difenoconazole. Similar findings were reported by Sharma *et al.* (2018) in tomato. In present study, lowest mean mite, defoliator and potato tuber moth infestation was recorded in demo plot which might be due to adoption of integrated pest management (IPM) practices by the farmers. These results are in agreement with Hanafi (1999) and Yasar (2011).

In conclusion, the improved IPDM practices in potato demonstrated by the KVK against major insect pests and diseases proved to be highly effective. Further, they also found to be remunerative and region specific for the potato growers of the district.

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